I. 35 U.S.C. § 112, Second Paragraph

Claim 24 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. This rejection is believed overcome by the amendment made in this reply.

Therefore the rejection of claim 24 under 35 U.S.C. § 112, second paragraph has been overcome.

II. 35 U.S.C. § 103, Obviousness

The examiner has rejected claims 1-3, 21-23 under 35 U.S.C. § 103(a) as being unpatentable over Sugawara et al. in view of Roth et al. (4,958,245). This rejection is respectfully traversed.

Claims 1-3, 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugawara et al. in view of Roth et al. (4,958,245).

With regards to claim 24, the Office Action states:

> Sugawara et al. teaches a system that adjusts the position of a magnetic head (7) with a positioning actuator or carriage mechanism (7-14) by using an optical servo module structure as depicted in figures 3-5. This module comprises an optical beam source (10b) a detector (10c) and an optical beam interference composition or hologram arrangement (10a) that produces a pattern (K1-K3) on a target. These features satisfy the corresponding features of claims 1 and 21. Claim 1, 21 and 22 state that the system is used in conjunction with a magnetic tape, where the arrangement taught by Sugawara et al. is used with a magnetic disk. Roth et al. teaches that it is well known to use such positioning arrangements in a variety of medium devices including a magnetic but also a magnetic tape arrangement (Roth et al.) since the type of medium used does not change the operation of the optical tracking arrangement as set forth. The claimed wrap angle (claim 22) is inherent in the teaching of Roth when used in a magnetic tape environment. Claim 2 sets forth that there is two detectors. Although Sugawara et al. does not specifically indicate the number of detecting elements in detector (10c), Roth et al. specifically teaches a detector (50) that is comprised of two elements (52) which inherently provides a more accurate reading of the reflected light. Such a detector as

taught by Roth et al. would have been obviously incorporated into the arrangement of Sugawara et al. in order to achieve a more accurate reading of the detected light. Claims 3 and 23 set forth that the optical servo module is fixed between the read and write heads. Sugawara et al. appears to have the module attached to the head. The placement difference is deemed to be a design choice that one of ordinary skill could have made through routine engineering practice. There does not appear to be any added benefit to this minor placement difference and therefore would have been obvious to vary the location of the module at various locations on the head without breaking the bounds of invention.

Analysis:

Claim 1 of the present application is reproduced below:

1. A compact optical tracking system for magnetic tape, comprising:

a magnetic head assembly;

a positioning actuator for changing the position of the magnetic head assembly; and

an optical servo module structure for outputting a position signal to the positioning actuator, causing the positioning actuator to change a position of the magnetic head assembly, wherein the optical servo module structure comprises at least one optical servo module, comprising:

an optical beam source for emitting an optical beam;

a detector for detecting an optical beam reflection; and

an optical beam interference composition for interfering with the optical beam and producing a predetermined pattern on a target.

Independent Claims 1 and 21 include the limitation, "an optical beam interference composition for interfering with the optical beam and producing a predetermined pattern on a target." This limitation is not shown in the cited references.

Particularly, the Examiner points to reference number 10a of various figures from Sugawara as teaching such an interference composition. However, the object 10a is not an interference composition, but instead an optical device for splitting a beam into

multiple beams by means of diffraction and reflection. The multiple beams formed by the diffraction composition of Sugawara are then reflected multiple times between two parallel plates so they can be targeted onto the proper area of the recording medium.

For example, Sugawara states at column 6, lines 34-37,

> Also, 10a is a hologram portion including a plurality of optical means such as a lens, an optical reflection element and the like and is made of a transparent polyolefin group plastic material in the form of a plate...

Later, Sugawara further describes the optical element 10 at col. 9, lines 17-27:

> Also, 10a8 is a first optical diffraction grid of the reflection type, also referred to as a diffraction grating disposed in the light path 10a5 for dividing the light from the light emitting portion 10b into a plurality of light beams. The diffraction grid 10a8 may be of a rectangular shape having a pitch of 13.1 ...and a depth of 0.01....10a9 is a beam splitter which is a second optical diffraction grid for inputting a 0-powerreflected light out of the plurality of light beams from the first optical diffraction grid 10a8 to a reflection type Fresnel lens 10a10 and outputting a first-power diffraction light out of the plurality of light beams from the recording medium 50....

These passages describe the parts of element 10a as using diffraction and reflection to divide and manipulate the beams, unlike the claim language of Claims 1 and 21, which call for "an optical beam interference composition for interfering with the optical beam **and** producing a predetermined pattern on a target." [Emphasis added.]

The diffraction element 10a8 of Sugawara does not teach the interference composition of Claims 1 and 21. Though holographic element 10a may arguably produce a pattern on a target, **it does not do so by means of interference.** Any "pattern" is produced by means of diffraction and reflection, a different physical process than interference producing different results and requiring different hardware. The method employed by Sugawara lacks some important advantages, as discussed below.

Diffraction (the process used in Sugawara) is the bending of light, while interference (as claimed in the present application) is the superposition of two coherent light beams causing constructive and destructive interference, where two or more light beams add to and cancel one another depending on relative phase. No apparent mention is made of interference or an interference composition with respect to element 10a (or any other element) of Sugawara.

Since Sugawara uses diffraction and reflection instead of interference to produce a pattern, an important advantage of the present invention is lacking from Sugawara. Namely, when an interference pattern is used, multiple sets of spots can be produced on the target and averaged to reduce error as described in the present application at page 11, line 27 through page 12, line 13:

> As the tape moves under the fringe patterns, the effect of damaged servo tracks and surface contamination is averaged out by the multiplicity of fringes in the A and B groups, six fringes each in the example of Figure 2. Additional averaging is obtained by combining the signals from all A detectors and all B detectors, either in the analog domain or the digital domain. Averaging of this kind is particularly effective in the case where there is only one strong fringe or illumined spot in each group. In the event that the servo tracks under one group of fringes are badly degraded, algorithms can be implemented in the digital domain to eliminate the signals from the corresponding A and B detectors from the averaging process. Averaging overall fringe groups also minimizes the effect of dimensional changes in the tape caused by operating temperature and humidity, or by aging of the tape substrate.

Since Sugawara uses diffraction/reflection instead of interference, an entirely different apparatus would be necessary for Sugawara to implement the error correcting averaging described above. For example, Sugawara might add more beam splitters to subdivide the source light more times than described in Sugawara. However, implementing more beam splitters into the holographic element 10a would also require redesign of the reflection and diffraction properties of the holographic element 10a, as

each new light beam produced would require its own new (and unique) reflecting and diffracting path through element 10a. Such a change to the teaching of Sugawara would at least require a significantly more complex holographic element 10a.

It is therefore respectfully asserted that Sugawara does not teach the claimed limitation of, "an optical beam interference composition for interfering with the optical beam and producing a predetermined pattern on a target."

Sugawara also teaches away from the claimed limitation, "an optical beam interference composition for interfering with the optical beam and producing a predetermined pattern on a target." Implementing an interference composition in place of Sugawara's optical element 10a would eliminate much of the innovation of Sugawara, as Sugawara focuses on the composition of the reflective films therein to achieve advantage over prior art systems. Sugawara's optical element 10a, which Examiner characterizes as an interference composition, actually comprises several elements, as shown in Figure 5. For example, 10a comprises first and second film layers 10a1 and 10a2, third and fourth film layers 10a3 and 10a4, input/output surfaces 10a6 and 10a7, diffraction grid 10a8, beam splitter 10a9, Fresnel lens 10a10, and anti-reflection film 10a11. The combined function of these elements is partly described at col. 9, lines 7-10:

> In Fig. 5, 10a5 is a light path defined by the first reflection surface 10a3 and the second reflection surface 10a4 for propagating the light in a zig-zag manner within the hologram portion 10a.

The system of Sugawara sends a single beam into the element 10a, which uses diffraction gratings and beam splitters to divide the beam into two or more beams which are reflected between films until they are properly aimed, and then they are reflected from the recording medium to position the head relative to the medium. No interference is required or taught in Sugawara.

Hence, it is respectfully asserted that element 10a does not teach the claimed limitation of, "an optical beam interference composition for interfering with the optical beam and producing a predetermined pattern on a target," as claimed in at least independent Claims 1 and 21.

Therefore, since Claims 2-7 and 18-20 depend from Claim 1, and since Claims 22-23 depend from Claim 21, Claims 1-7 and 18-23 are believed distinguished over the cited references.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sugawara et al., Roth et al. and Smith as applied to claims 4, 5, 18 and 19 above, and further in view of Farnsworth et al. (5,121,371). The Examiner states:

> The teachings of Sugawara et al. Roth et al. and Smith are discussed above and incorporated herein. Claim 20 further sets forth that the optical beam interference composition is two or more parallel slits. Sugawara et al. uses a hologram type (HOE) of interference composition. Farnsworth et al. teaches in column 4 that a (HOE) can be replaced with a pair of slits to obtain the same result. It would have been obvious to one of ordinary skill in the art to replace the (HOE) type of interference composition as taught by Sugawara et al. with a pair of slits as taught by Farnsworth et al. to obtain the same result and to use this modified teaching of Sugawara et al. with Roth et al. and Smith in a similar manner as previously discussed in paragraph 7.

Analysis:

Claim 20 sets forth that the optical beam interference composition is two or more parallel slits. Though Farnsworth teaches that an HOE can be made to imitate a pair of slits, making the changes to Sugawara necessary to implement such a change is not obvious and would destroy the intended function of Sugawara. As argued above, merely replacing what Examiner characterizes as hologram arrangement 10a with an HOE forming two slits would not form the present invention or teach all limitations of, for example, Claim 1. This is because the element 10a of Sugawara performs duties different than those of a double slit interference pattern, as argued above, including those of a diffraction grating, beam splitter, and various reflective and non-reflective surfaces for targeting and controlling the split beams into a "zig-zag pattern". Furthermore, it is reiterated that Sugawara does not function by means of interference, but by diffraction, and interference is apparently not mentioned in Sugawara.

Therefore it would not have been obvious to one of ordinary skill in the art to combine the proposed references. Claim 20 is therefore believed distinguished over the cited references.

III. 35 U.S.C. § 102, Anticipation

Claims 24-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Sugawara et al. (6,128,155).

With regards to claim 24, the Office Action states:

> Sugawara et al. teaches a system that adjusts the position of a magnetic medium with respect to a magnetic head (7) with a positioning actuator or carriage mechanism (7-14) by using an optical servo module structure as depicted in figures 3-5. This module comprises an optical beam source (10b) a detector (10c) and an optical beam interference composition or hologram arrangement (10a) that produces a pattern (K1-K3) on a target. The reflected light beams (L1-L3) are then used by detecting intensities (column 121, lines 1-4) to control the position of a servo track (50a) with respect to the head. This teaching satisfies the limitations of claims 24-26.

Analysis:

The Examiner rejects Claims 24-26 over Sugawara et al. Claim 24 is reproduced below:

> 24. An optical tracking system for aligning a recording medium, comprising:
>
> at least one source of coherent electromagnetic radiation;
>
> an interference generating device;
>
> wherein the interference generating device causes the superposition of coherent radiation emitted from the at least one source to form at least two spots on the recording medium;
>
> wherein the two spots are formed at different distances from a track on the recording medium;
>
> wherein the direction and magnitude of offset of the track is determined based on the relative locations of the at least two spots with respect to the track.

This claim includes the limitation, "an interference generating device;" similar to the limitations of Claims 1 and 21 argued above. It is believed that the arguments in favor of Claims 1 and 21 apply to Claim 24, since both refer to an interference causing element, and since no interference causing element is shown in Sugawara; and since particularly element 10a of Sugawara is not an interference generating element.

Hence, Claims 24-26 are believed distinguished from the cited references. Therefore, the rejection of claims 24-26 under 35 U.S.C. § 102 has been overcome.

IV. New Claim

New Claim 27 has been added. This claim finds support in the specification at pages 11 and 12. New Claim 27 is reproduced below:

> 27. (NEW CLAIM) The optical tracking system of Claim 24, wherein the at least two spots comprise a first group of spots and a second group of spots, wherein the intensity of the first group of spots is averaged and the intensity of the second group of spots is averaged.

This claim is believed allowable over the cited references at least for the limitation, "the at least two spots comprise a first group of spots and a second group of spots, wherein the intensity of the first group of spots is averaged and the intensity of the second group of spots is averaged." This limitation is not believed shown in the cited references, and favorable consideration of this claim is respectfully requested.

V. Conclusion

It is respectfully urged that the subject application is patentable over the cited references and is now in condition for allowance.

The examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

DATE: 1.7.02

Respectfully submitted,

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Redacted Claims

24. (ONCE AMENDED) An optical tracking system for aligning a recording medium, comprising:

at least one source of coherent electromagnetic radiation;

an interference generating device;

wherein the interference generating device causes the superposition of coherent radiation emitted from the at least one source to form at least two spots on the recording medium;

wherein the two spots are formed at different distances from a track on the recording medium;

wherein the direction and magnitude of offset of the [servo] track is determined based on the relative locations of the at least two spots with respect to the track.

27. (NEW CLAIM) The optical tracking system of Claim 24, wherein the at least two spots comprise a first group of spots and a second group of spots, wherein the intensity of the first group of spots is averaged and the intensity of the second group of spots is averaged.